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and the Christian religion a dream. And later, it was said, if physical and vital forces are correlated with each other, there is no soul, no distinction of right and wrong, and no immortality. And again it was said, if species originate by evolution, and not by special creation, there is no God. So it had been said centuries before, if the earth revolves around the sun, Christian faith must be abandoned as a superstition. But in the nineteenth century, as in the sixteenth, the scientific conclusions won their way to universal acceptance, and Christian faith survived. It showed a plasticity which enabled it to adapt itself to the changing environment. The magically inerrant Bible may be abandoned, and leave intact the faith of the church in a divine revelation. The correlation of forces acting in the human cerebrum with those of inorganic nature may be freely admitted; and yet we may hold that there are other forms of causation in the universe than physical energy, and that the inexpugnable belief of moral responsibility is more valid than the strongest induction. The 'carpenter God' of the older natural theology may vanish from a universe, which we have come to regard as a growth and not a building; but there remains the immanent Intelligence

"Whose dwelling is the light of setting suns,
And the round ocean, and the living air,
And the blue sky, and in the mind of man;"—

the God in whom 'we live and move and have our being.'

The church has learned wisdom. The persecution of Galileo is not likely to be repeated, nor even the milder forms of persecution which assailed the geologists at the beginning, and the evolutionists in the middle, of our century. And science, too, has learned something. In all its wealth of discovery, it recognizes more clearly than ever before the fathomless

abysses of the unknown and unknowable. It stands with unsandaled feet in the presence of mysteries that transcend human thought. Religion never so tolerant. Science never so reverent. Nearer than ever before seems the time when all souls that are loyal to truth and goodness shall find fellowship in freedom of faith and in service of love.

WM. NORTH RICE.

*RESULTS OF THE SECOND BOTTEGÒ EXPEDITION INTO EASTERN AFRICA.**

UNDER the auspices of the Italian Geographical Society, whose President signs the preface, the survivors of the Second Bottegò Expedition into Eastern Africa have prepared and published a narrative of their arduous journey, and an account of the results achieved at the cost of two valuable lives. The volume is well written and profusely illustrated—it is, moreover, accompanied by a series of clearly drawn maps of the country traversed, much of which had been previously unvisited by European explorers.

On his second expedition Vittorio Bottegò, accompanied by three valiant assistants—Lamberto Vannutelli, Lieutenant in the Royal Navy; Carlo Citerni, of the Italian Army, and Dr. Maurizio Sacchi, left Naples on the 3d of June, 1895, and reached Brava on the Southern Somali coast on the 1st of October of that year. Ten days later the explorers marched out of Brava with a caravan of 250 Ascaris, and on November 18th reached the outskirts of Lugh, an important emporium of trade in Southern Somaliland, situated on the River Juba in about 3° north latitude, which had been visited by Bottegò on his first expedition. Lugh, it was found was

* L'Omo. Viaggio di esplorazione nell' Africa Orientale narrato da L. Vannutelli e C. Citerni. Sotto gli auspici della Società Geographica Italiana. Milano, 1899.

at that time in possession of a band of predatory Abyssinians, who of late years, as is well known, have traversed and ravaged the whole of southern Somaliland. Alarmed, however, by the reports of the advancing caravan of Italians, the Abyssinians had withdrawn leaving Lugh in ruins and completely deserted, as the native inhabitants had taken refuge on the other side of the river. Lugh lies on a peninsula of land nearly surrounded by a bend of the River Jutz, and defended by a wall some 200 meters in length which crosses the isthmus from bank to bank. The Italians were naturally well received on their arrival as deliverers from the much hated Abyssinians, and were treated in the most friendly way. After a few days they induced the population to return to their deserted city, and reinstated the Sultan of Lugh—Ali Hassan Mir on his tottering throne. A fort was built and a guard of 45 Askari left in it for the protection of the inhabitants against further invasions while a treaty of perpetual alliance between Italy and the Lughians was drawn up and signed.

Some distance above Lugh the Juba is divided into three branches—the Ueb coming from the north, the Ganula Doria from the northwest and the Daua from the west. After a month's delay, during which an excursion up the Ueb in order to restore some captives to their friends was made by some of the party, the expedition was reunited at the end of January, and proceeded up the valley of the Daua or great western branch of the river Juba, along the caravan road which leads to the region of the lakes. On the 2d of February they crossed from the left to the right bank of the Daua, and continued thence at some distance from its banks through the country of the Garra-Somali, then passing into that of the Bóran, a race of pacific shepherds speaking a Galla tongue. Leaving the water-basin of the Daua to the left, and proceeding through

the hills, the party arrived on March 17th at Ascebo—a large village of from 300 to 400 houses—on the outskirts of the Bóran country. A few days later they arrived on the banks of the Bisan-Gurracia, the first water met with flowing in a western direction. Burgi, a pleasant village in the mountain of the Amarr-Bambsla, was reached on March 30th, and the tomb of Eugenio Ruspoli, an Italian explorer who was accidentally killed there some years before, was visited.

The route taken hence was northward along the Badditu range until a new lake 'never before seen by European eyes' was discovered on May 12th. Lago Regina Margherita, as it was agreed to name this fine sheet of water after the Queen of Italy, is surrounded by lofty mountains, some of which are said to attain a height of nearly 11,000 feet. Twenty-five days were spent on the exploration of this beautiful lake, which is about 250 kilometers in circumference, and lies at a height of 4200 feet above the sea-level. Just south of it, divided by low ground, is another smaller lake—Lake Ciamò, and the two together drain into Lake Stephanie, which lies some sixty or seventy miles to the southwest of them.

On June 12th, the exploration of the new Lakes having been completed and sufficient rest obtained, the explorers were ready to proceed onwards in search of the great river Omo, to trace the course of which was one of the principal objects of their expedition. It having been ascertained that the Abyssinians were in occupation of the country to the north of the new Lake, it was resolved to proceed due west through the mountains, and a most difficult task this proved to be. The path led through mountains from 9000 to 10,000 feet in altitude, and the natives were energetically hostile. But at the end of June they had traversed the range, and found themselves on the south bank of the much sought for river

which drains the southern provinces of Abyssinia. Unfortunately the Abyssinians had become well aware of their movements, and an Abyssinian Ras, Uoldu Ghirgis stood in battle array on the north bank ready to stop them. Turning away to the west through the mountains the Italians managed with great difficulty to escape their enemies, and, though hampered by constant attacks from the natives, succeeded in reaching the Omo again, and in descending its left bank to Lake Rudolf. It was thus shown that the great Abyssinian River Omo flows neither into the Nile as had been conjectured by some geographers, nor into the Juba, as had been supposed by others, but constitutes the principal feeder of the internal basin of Lake Rudolf. That a large river entered this Lake at its northern extremity was well known from former explorations. But no one had shown its identity with the Abyssinian Omo, which was thus fully established. On August 30, 1895, the Italian travellers found themselves at the north end of Lake Rudolf in occupation of the cabin of Dr. Donaldson Smith, the American explorer, who had been in the same spot about a year before them.

The chief object of the second Bottegò expedition had thus been accomplished. The Omo had been traced to its outlet in Lake Rudolf. Besides this many miles of fresh country had been traversed, and a new and most interesting lake discovered—not only discovered, but carefully measured and mapped, as will be seen by the charts attached to this volume.

Had the voyagers gone home by the usual route through British East Africa, or returned by the way they came they would have been allowed the credit of having done excellent work. But they were still ardent for further discoveries.

In the first place a side-excursion was made by Bottegò and Vannutelli to Lake

Stephanie. The river Sagan, which drains Lakes Margherita and Ciamò, and which they had struck on their former route to Burgi, was found running into the head of Lake Stephanie. It was a good elephant country, and 14 elephants were killed in five days. The tusks together with the ivory previously procured were sent off to Lugh by a Somali caravan. On October 18th the whole party was again assembled at Bumé, at the northeast corner of Lake Rudolf.

Here it was resolved, on consultation, that Dr. Sacchi should proceed home via Lugh with ivory and the scientific collections already accumulated, while the remaining members of the party should continue their explorations. Dr. Sacchi reached Ascebos safely, but on returning to Lake Margherita to fetch some ivory placed in cache there, was unfortunately killed in an encounter with the natives some four months later (February 7, 1897).

Before leaving Lake Rudolf the remaining explorers resolved to make it quite certain that no river flowed out on the western side of the lake. The western bank of Lake Rudolf was, therefore, carefully examined as far south as about 3° N. L., where the river Tirog flows from the west into the lake. Beyond this it had been already ascertained that there was no water issuing out of Lake Rudolf, which is, therefore, a closed basin, and has no connection with the Sobat and so with the Nile, as had formerly been supposed possible.

Starting again from the north end of Lake Rudolf on December 13, 1896, the travellers proposed to make their way home through Abyssinia, little aware of the unfortunate series of events which had taken place between that country and Italy. Leaving the large northeastern gulf of the lake on their right, they arrived shortly on the river Sacchi, as they proposed to name this stream after their lost com-

panion, and ascertained that though flowing directly southwards it did not at that time actually reach Lake Rudolf, but probably passed into it only by infiltration.

For ten days the River Sacchi was ascended, through a fine and fertile country, but with few inhabitants. At about $5^{\circ} 30' \text{ N. L.}$ this river was quitted for the adjoining mountain range on the left, and after passing the water—parting at some 5700 feet in altitude a descent was made into the valley of the Sobat or strictly speaking that of the Guibà or Acobo—one of its principal southern confluent. The Guibà was reached on January 3, 1897, in about $6^{\circ} 30' \text{ S. L.}$ and 35° E. L. It was here found to be a stream of about 200 feet in breadth and a foot and a half deep—some 30 or 40 miles from its sources in the mountain of Caffa. The descent of the Guibà was commenced on the left bank. A few days later the stream was crossed and progress was continued on the right bank some way from the stream, which was regained at Ghira, the first village in the extensive district of Jambò. Here it was found that a tongue nearly allied to that of the Shilluks of the Upper Nile was spoken, and intercourse was opened with the natives by one of the Ascari who happened to be of a native of Fashoda, but there were great difficulties about guides. Finally it was determined to proceed to the north, and another confluent of the Sobat—the Ghélo, a limpid stream running placidly westward—was reached on January 23, 1897. On attempting to descend the Ghélo the party became involved in marshes and much harassed by hostile natives, and were obliged to return to their former quarters on the Ghélo which were regained on February 6th, after serious losses in men and baggage animals. After a few days' journey up the Ghélo, during which a new lake, proposed to be called Lake Gessi, was discovered, that river was left, and a course

nearly due north was taken which brought the party after crossing several smaller affluents on the 26th of February, 1897, to the main stream of the Sobat in $8^{\circ} 10' \text{ N. L.}$ The Sobat or (Upeno) is here a fine stream of 900 feet in width and 3 feet in depth, flowing through a fertile and thickly populated valley. Crossing the river with the assistance of the natives, which here were still of the Jambo tribe, the party continued up the right bank for several days, and then left the river to ascend the Abyssinian mountains—which border the valley on the north. Before doing this, however, a letter was sent to the Abyssinian Resident in the adjoining districts of the Sajo asking for permission to pass through his country. In reply to this some Abyssinian soldiers were dispatched to invite the Italians to come on, and to show them the way, and shortly afterwards they met Abba Cialla, brother of the Resident, Giotò di Lega, with a large *cortège* sent expressly to welcome them. On March 16th accordingly the weary travellers arrived at Jullem, near Gobo, the residence of the Desgatch, and were most cordially received. Surely now, they thought, their long tramp had come to an end and they would have an easy passage across Abyssinia to their countrymen at Cassatà. Never were such expectations more miserably disappointed. The treacherous Abyssinians made an attack on the Italian camps on the night of March 17, 1897. Captain Bottegò was killed, Citerni was wounded, and the whole of the party either slaughtered or taken prisoners. Citerni and Vannutelli were imprisoned in irons, and most shamefully abused and treated until June 13th, when orders were received from Menelek that they should be sent up to Addis Abeba. Although these orders were complied with it was not until the day of their entrance to the capital that their chains were removed. At Addis Abeba, which was

finally reached on June 22, 1897, Van-nutelli and Citerni, the two surviving members of the Second Bottegò Expedition were most cordially received by the Italian Envoys—Major Nerazzini and Captain Ciccodicola, and arrangements were quickly made for their return to Europe.

Among the perils and dangers of such a journey as this especially when the great difficulties of transport are taken into consideration, the collection of scientific specimens is by no means an easy task. Yet, as will be seen by reference to the Appendix to the present volume, the members of the Second Bottegò Expedition by no means neglected this part of their duties. After the geological, meteorological, and astronomical observations are given we find a summary of the zoological results prepared by Dr. Gestro of the Museo Civico of Genoa. These are based on specimens obtained during the first part of the journey between Brava and Lake Rudolf which, however, formed but a very small proportion of the whole collections. The Mammals have been described by Mr. Oldfield Thomas of the British Museum in two papers published in the Annals of the Museo Civico of Genoa, the first relating to 27 species and the second to 20, one of which (*Crocidura bottegi*) was new to science. The few birds saved from the wreck have been named by Count Salvadori, the Reptiles and Batrachians by Mr. Boulenger and the Fishes by Sigo Vinciguerra. Their reports have likewise appeared in the same well-known periodical. The more numerous specimens of Invertebrates have been worked out by various specialists of whose contributions the titles are given here, together with an abbreviated account of the principal novelties accompanied by many excellent illustrations. The value of this well prepared volume is further enhanced by the excellent series of maps attached to it, whereby every detail of the routes pursued may be followed

with the greatest ease. The name of Giacano Doria attached to the preface is a guarantee that neither trouble nor expense has been grudged in the production of the present volume as is indeed at once evident to all that examine it.

P. L. SCLATER.

LONDON ZOOLOGICAL SOCIETY.

ON THE CHEMICAL NATURE OF ENZYMES.

THE enzymes form one of the most interesting groups of organic compounds from the physiological as well as the purely chemical point of view. Physiologically they may be classified as follows:

1. Enzymes which are intimately connected with nutrition, as diastase, pepsin, trypsin, lipase, etc.

2. Enzymes which cause oxidations—the oxidases.

3. Enzymes which bring on coagulations, the clotting enzymes: rennet, thrombase, pectase.

The first group has been known longest and best and has served certain authors for inferences and distinctions which at present are no longer tenable. Erroneous views as to the rôle of enzymes are however now and then entertained even at the present day, actions being ascribed to them which belong exclusively to the living protoplasm itself. Thus, in an article on 'Assimilation and Heredity' the hypothesis was formulated that "enzymes are the true bearers of heredity." Thus far it has been the well founded inference that the molecular arrangement, the invisible organization or tectonic of the chromosomes forms the foundation of the genetic differentiation and heredity. These chromosomes consist principally of a nucleoproteid (chromatin) of a very labile nature, that is easily converted into a stable proteid by injurious influences which cause their death. The chromatin of the chromosomes of different animals may not be identical, but only iso-